

Risk Analysis:

An Essential Tool for Erosion Control Decision Making and Selecting Best Management Practices

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The goal of this presentation is to introduce the erosion control industry to a method that can be used for making decisions for dynamic construction projects.

Risk analysis can be used for both design and construction.

The analysis methods we are presently using are acceptable for measuring static, non changing conditions.



However, the methods are not adequate for construction sites which are quickly changing, equipment is working, and sites are very dynamic.

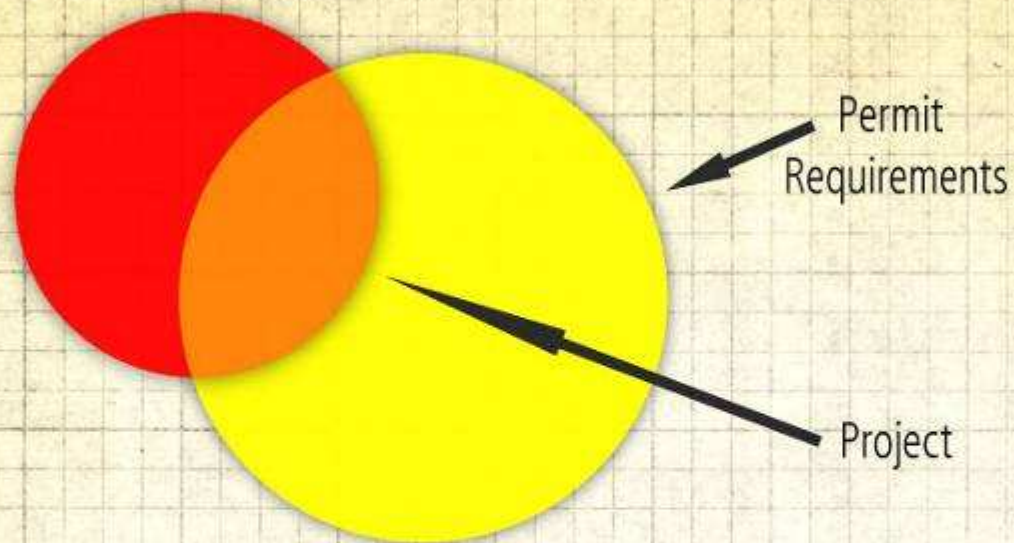
Taking Risk.... Not Implementing the SWPPP



Taking Unnecessary Risk



Using Risk Analysis to Manage the Site

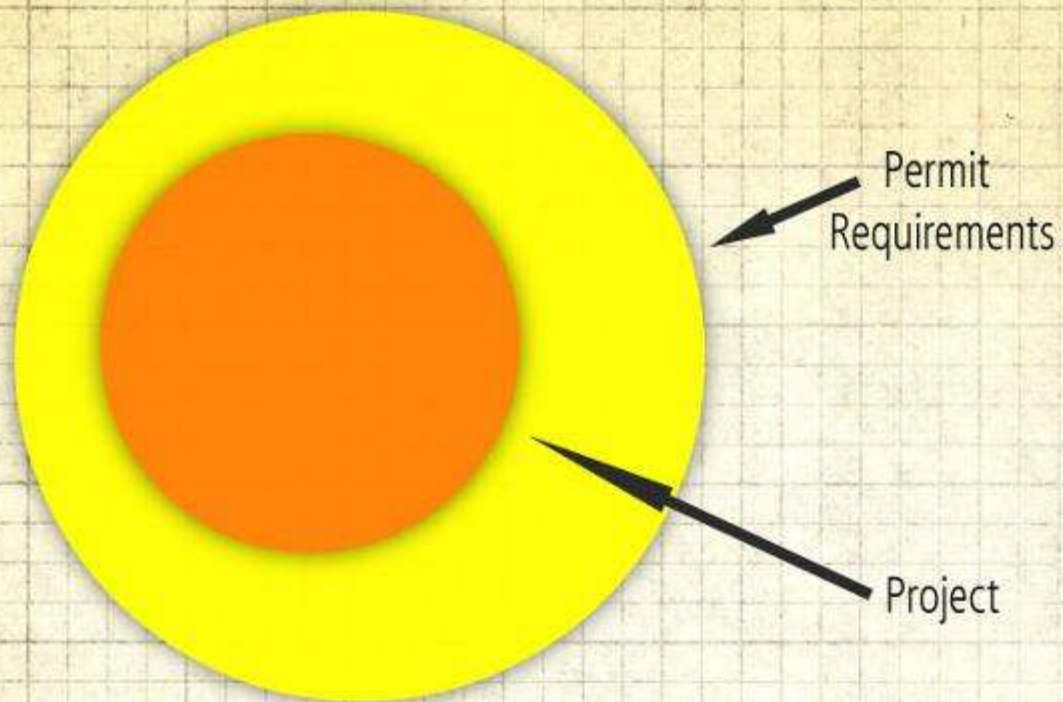


Some of the project is within the permit requirements
Most is out of the permit requirements

Managing the Risk



Using Risk Analysis to Manage the Site



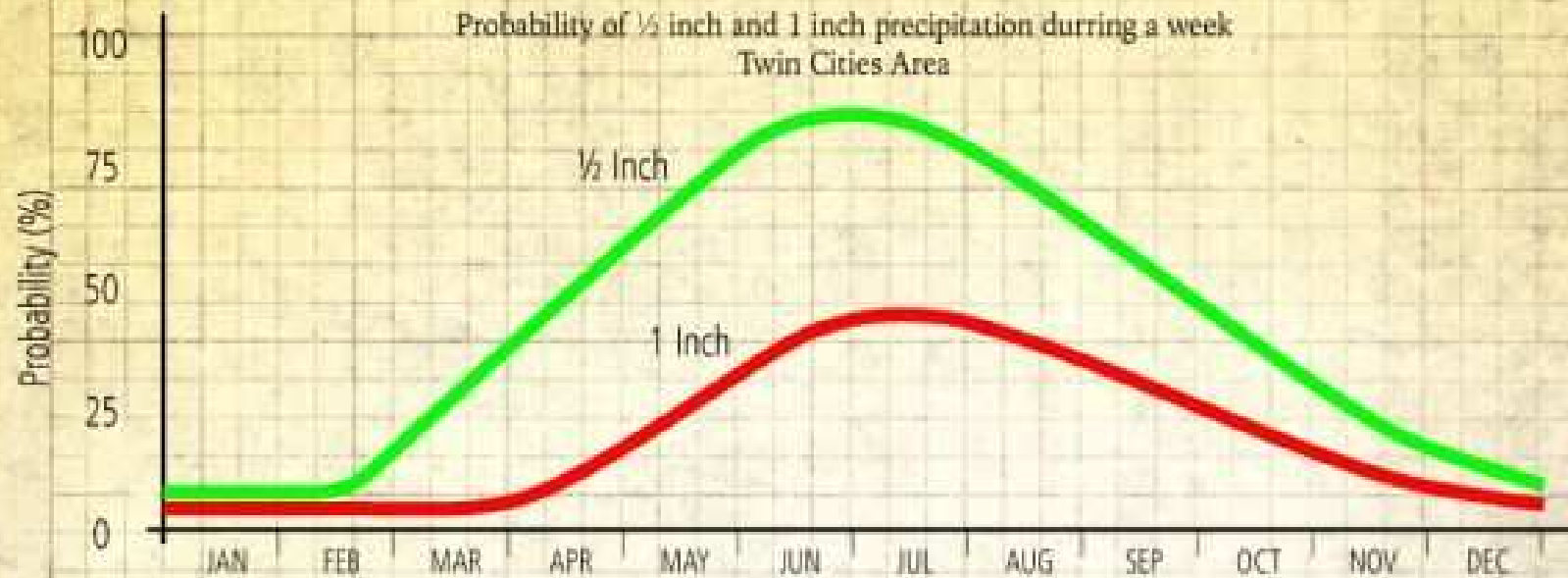
All of the project is within the Permit Requirements

We go out on road projects and get excited. But there is no response by the contractor. Why???



Precipitation Probabilities

Probability of $\frac{1}{2}$ inch and 1 inch precipitation during a week
Twin Cities Area



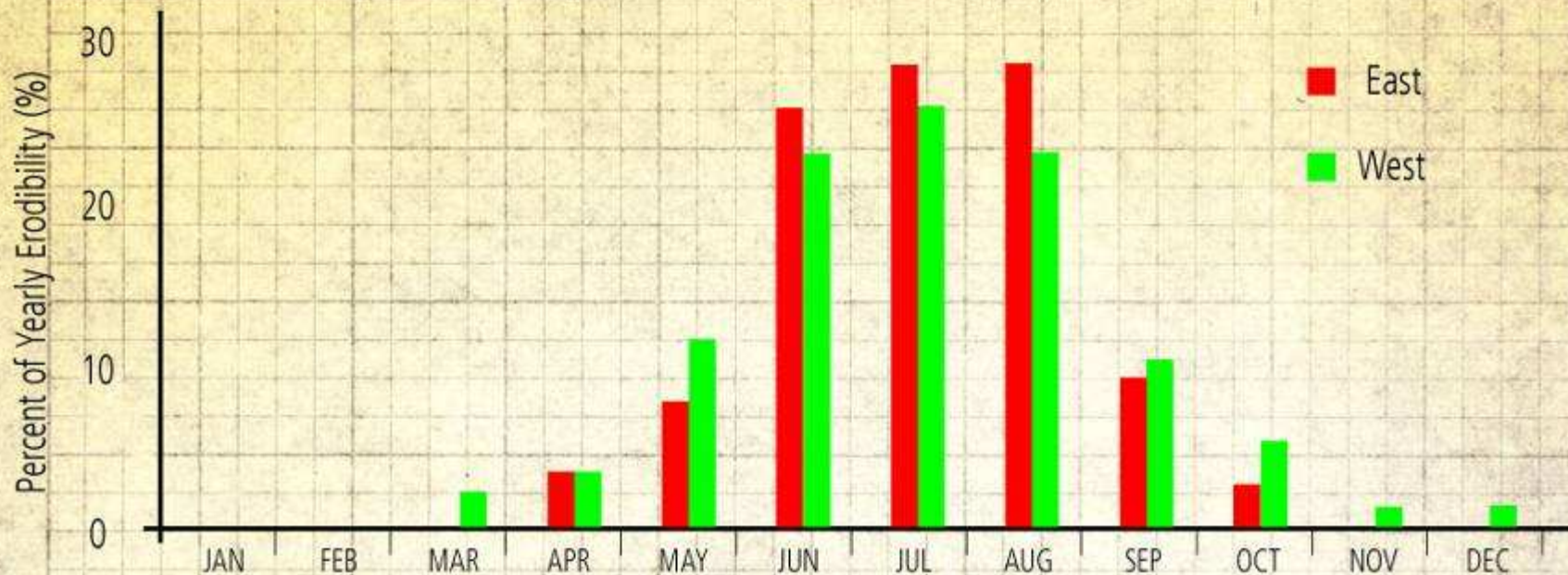
**By duration, the probability of a
Severe Erosion Event increases rapidly
with time of exposure.**

Probability of $\frac{1}{2}$ inch and 1 inch precipitation during a week or month time period.
Twin Cities Area



Probability of a 1 inch event

Percent of Total Erodibility Occuring Monthly



Schedule critical work during the periods
of the least risk potential

Use Risk Analysis for Scheduling Critical Work. For example compare the erodibility potential during the seasons of the year.

| Month | % Erodibility |
|--------|---------------|
| June | 22 |
| July | 24 |
| August | 22 |

Total= 68%

Vs

| Month | % Erodibility |
|----------|---------------|
| October | 4 |
| November | 2 |
| December | 1 |

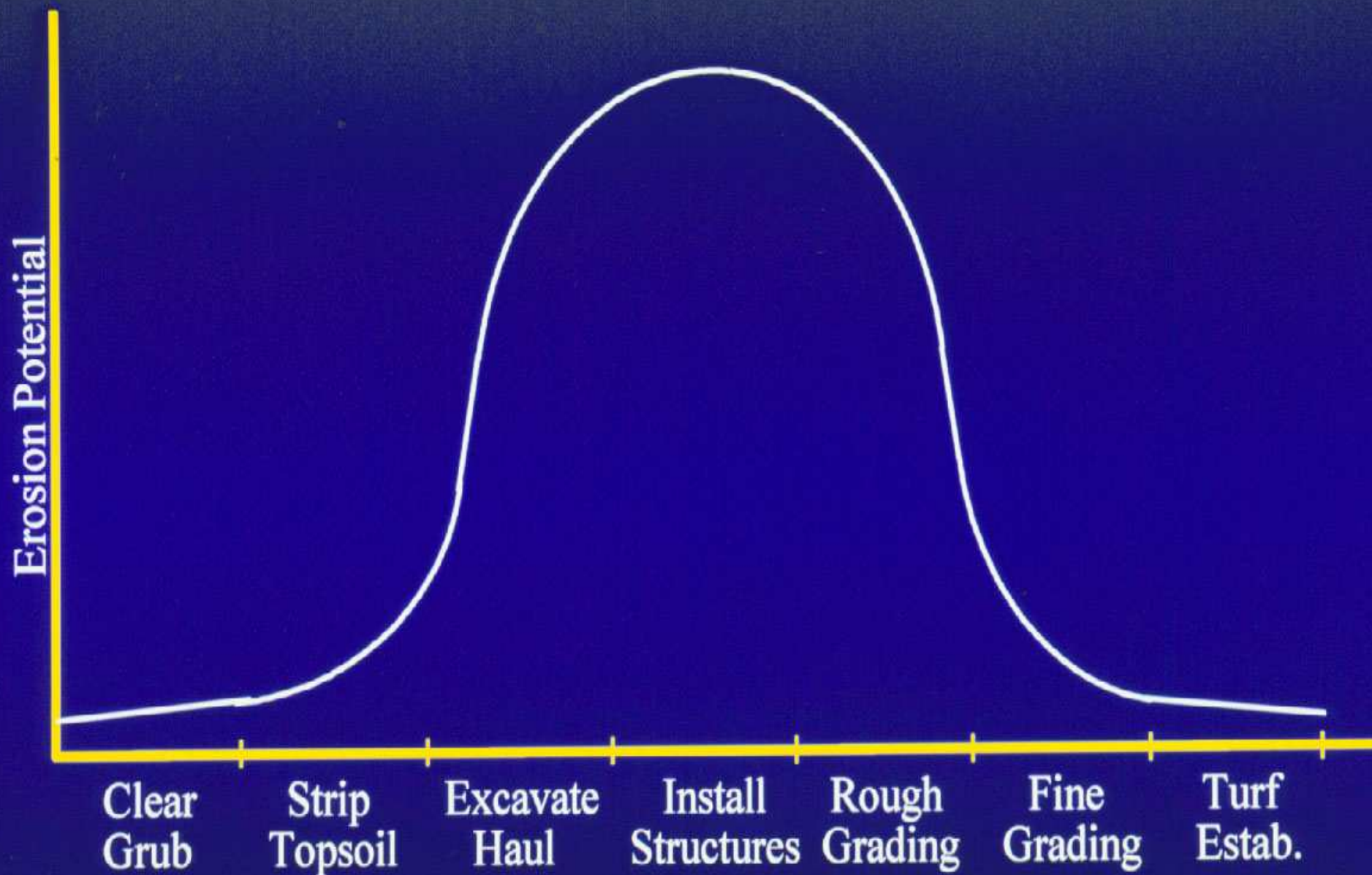
Total= 7 %



**Risk analysis is appropriate to
assess changes in erosion
potential with the contractor's
operations.**

First Construction Sequence Clearing and Grubbing





Typical Change in Erosion Potential With Construction Sequence

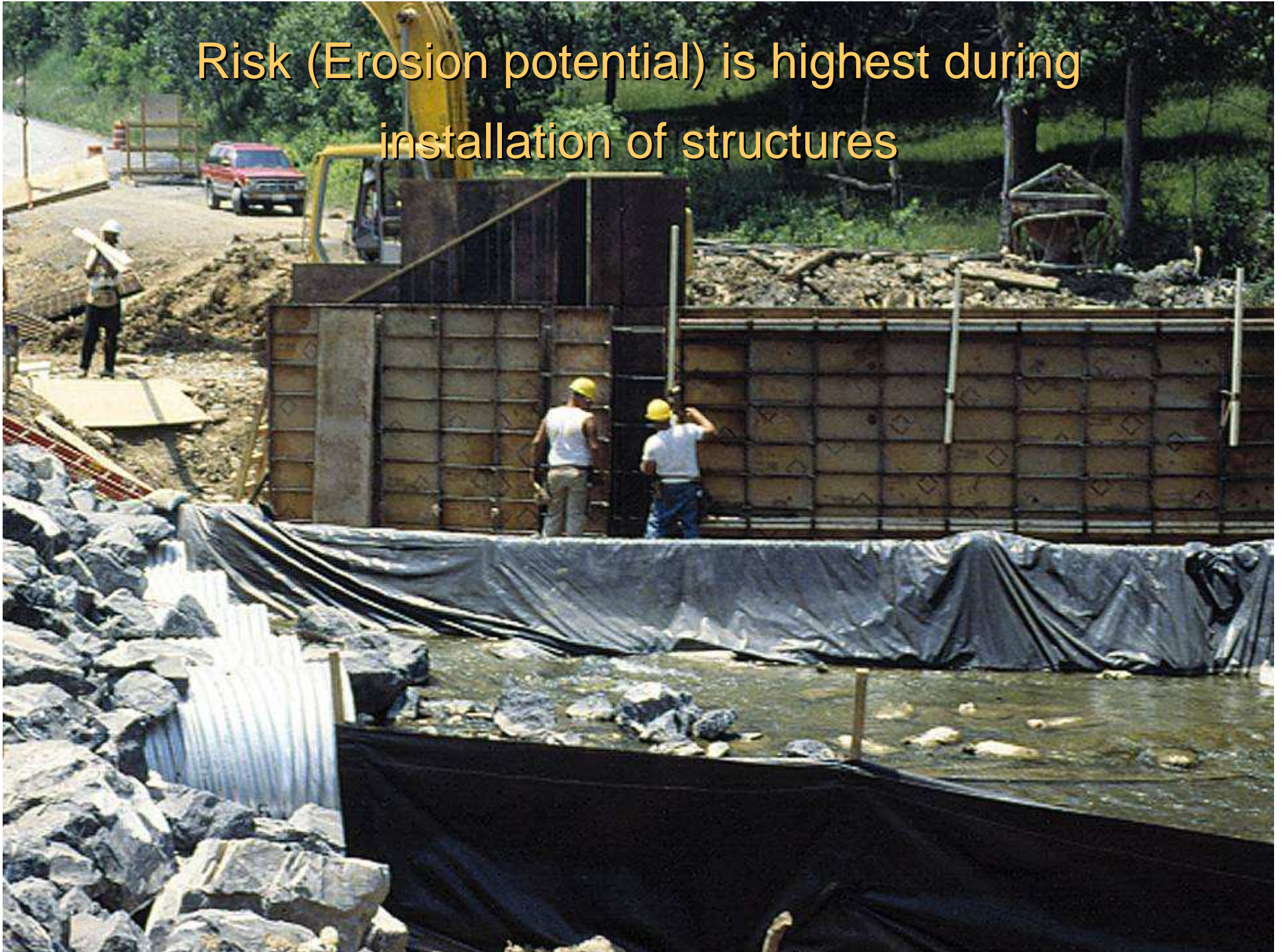
Contractors Open up Large Areas During the Grading



Use the resources on site during rough grading and manage the risk.



Risk (Erosion potential) is highest during
installation of structures



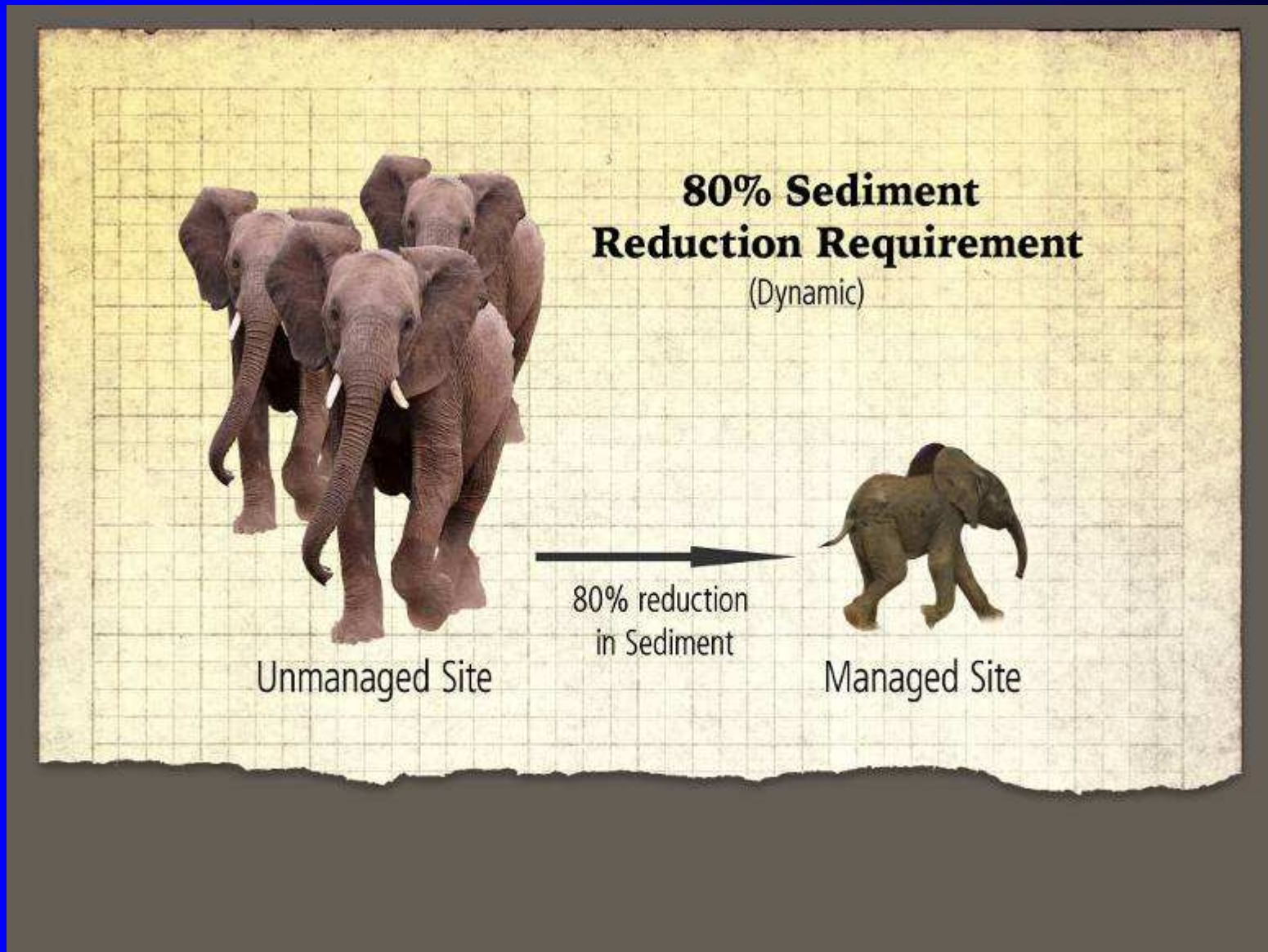


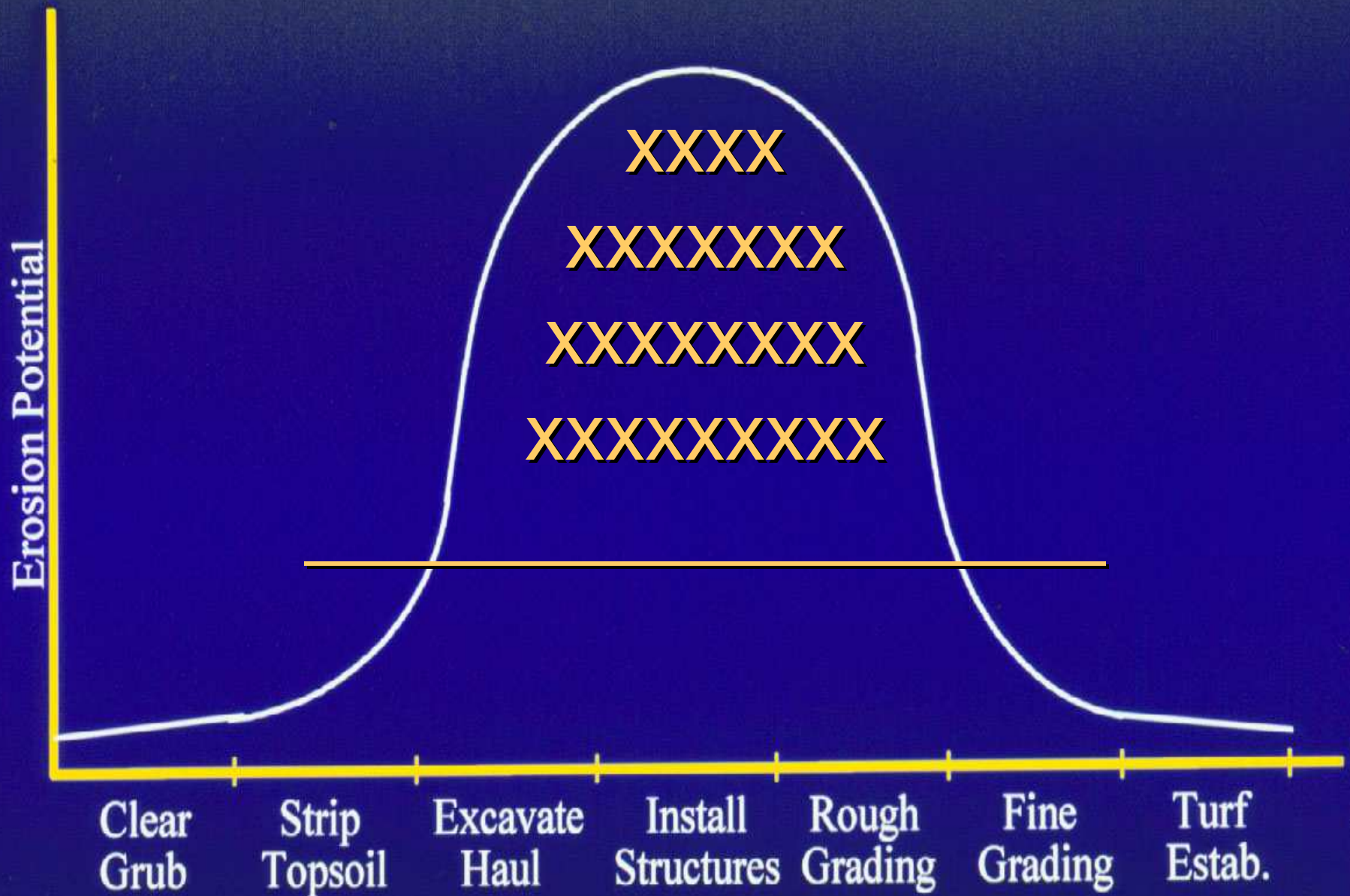
Should We Design Best Management Practices For Use During Construction or Just Leave The Installations to Chance?

Reduce Risk With Shaping and Topsoil Placement During the Grading Work



**Our goal is to have at least an 80 %
soil loss reduction**





Typical Change in Erosion Potential With Construction Sequence



Reduce risk during structure installations
by scheduling and working in the dry



Provide mulch either temporary or permanent to reduce risk near wetlands





Use risk analysis to select the level of BMP protection.

Decisions regarding the level of BMP protection should not be based on rules of thumb, but rather on risk assessment and probability of success.

Risk analysis applies the binomial distribution to determine the probability of success or failure

$$C^{1/n} = 1 - (1/T)$$

Where

C = confidence of success (percent),

n = number of years of project, and

T = capability of BMP (years).

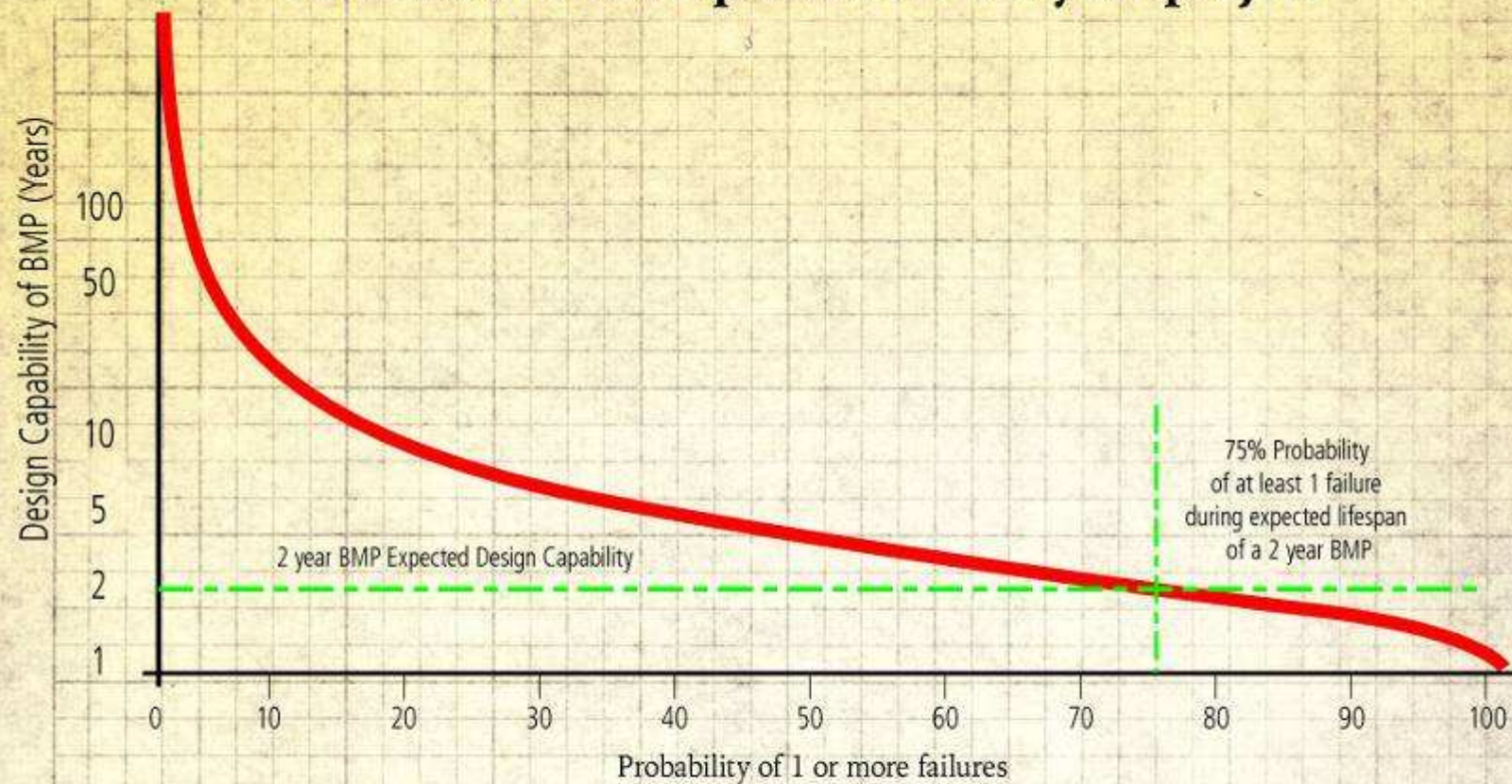
Success of 2yr BMP/ 1yr Project

- Most BMPs such as silt fence have capacity to handle a 2 yr 24 hr storm
- This assumes proper installation and “normal” rainfall intensity over 24hrs
- Using the binomial equation the probability of one or more failures is 50% over a 1 year project

What is the risk of failure? Is Silt Fence Adequate?



Solution of Risk Equation for a 2 year project



Risk analysis results for a two year project

| Capability of BMP (Yrs) | Confidence of Success (%) | Probability of Failure (%) |
|------------------------------------|--------------------------------------|---------------------------------------|
| 40 | 95 | 5 |
| 20 | 90 | 10 |
| 10 | 80 | 20 |
| 7.5 | 75 | 25 |
| 3.5 | 50 | 50 |
| 2.7 | 40 | 60 |
| 2.0 | 25 | 75 |
| 1.8 | 20 | 80 |

In other words, a BMP with a two year design capability has a 75 % probability of one or more failures over the two year project period.





**BMPs with a 10 year design capability
have a 80 percent probability of
success over the two year project.**

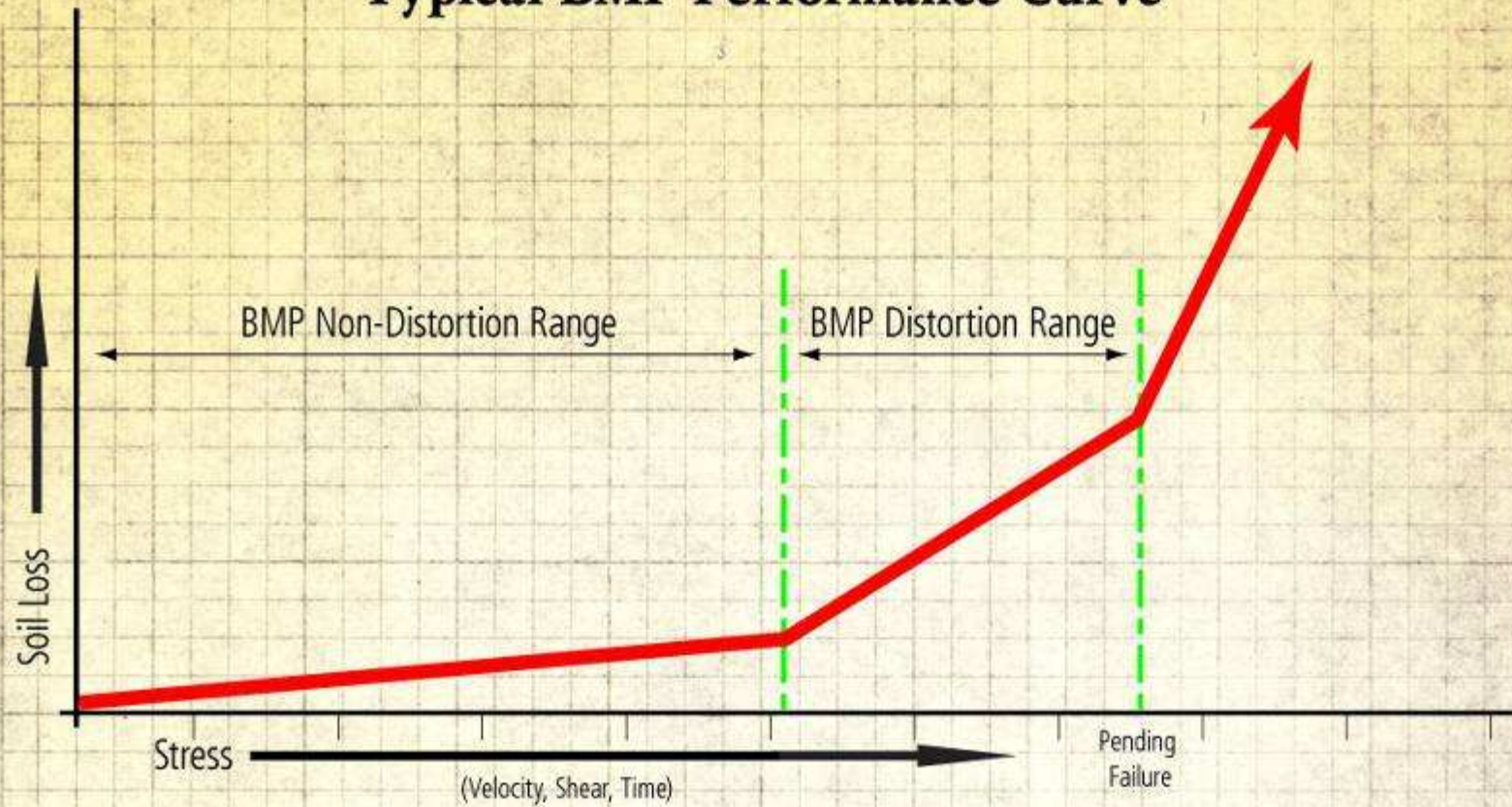




Risk analysis can also be used to determine the category or grade within a BMP for a specific application.

**Every BMP has a performance curve.
Where does your site fall on the performance curve?**

Typical BMP Performance Curve



Non-distortion application range



American
Excelsior
Company®
Earth Science Division





**Risk analysis can also be used to
determine maintenance intervals and
needs**

mtbf

(Maintenance Time Before Failure)

**For example after 1 ½ inches of
cumulative rainfall, inlet protection
needs cleaning.**





Applying risk principles learned for the design of the project

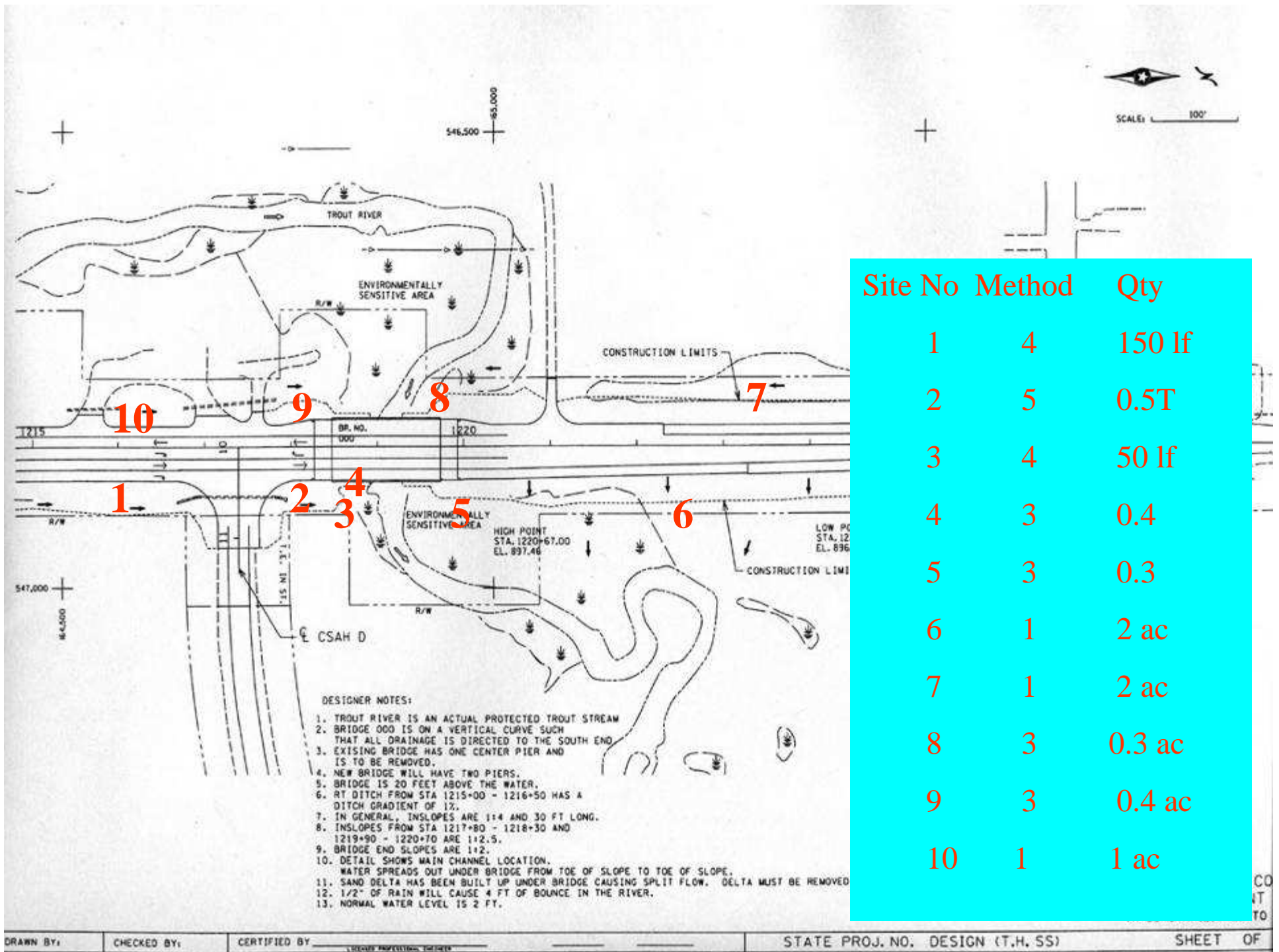
- **Identify high risk locations based on soils, slopes, and grades.**
- **Determine high risk locations based on adjacent resources such as lakes, rivers, streams, wetlands, and sensitive areas.**
- **Identify the high risk locations and color code them based on level of risk.**
- **Select and provide the appropriate BMPS for each location on the project based on risk potential.**
- **Also include protected species requirements in the risk decision making model**

Identify Wetland Types



Don't Use Silt Fence for Perimeter Control for All Wetlands





| Site No | Method | Qty |
|---------|--------|--------|
| 1 | 4 | 150 lf |
| 2 | 5 | 0.5T |
| 3 | 4 | 50 lf |
| 4 | 3 | 0.4 |
| 5 | 3 | 0.3 |
| 6 | 1 | 2 ac |
| 7 | 1 | 2 ac |
| 8 | 3 | 0.3 ac |
| 9 | 3 | 0.4 ac |
| 10 | 1 | 1 ac |

Temporary Erosion Control BMPs

- Designate the discharge points and disturbed areas draining to surface water bodies
- Provide Temporary erosion control (Rapid Stabilization) for designated areas
- Include number of areas, locations, and quantities for Rapid Stabilization

Provide Stabilization For Small Critical Areas in the Plan



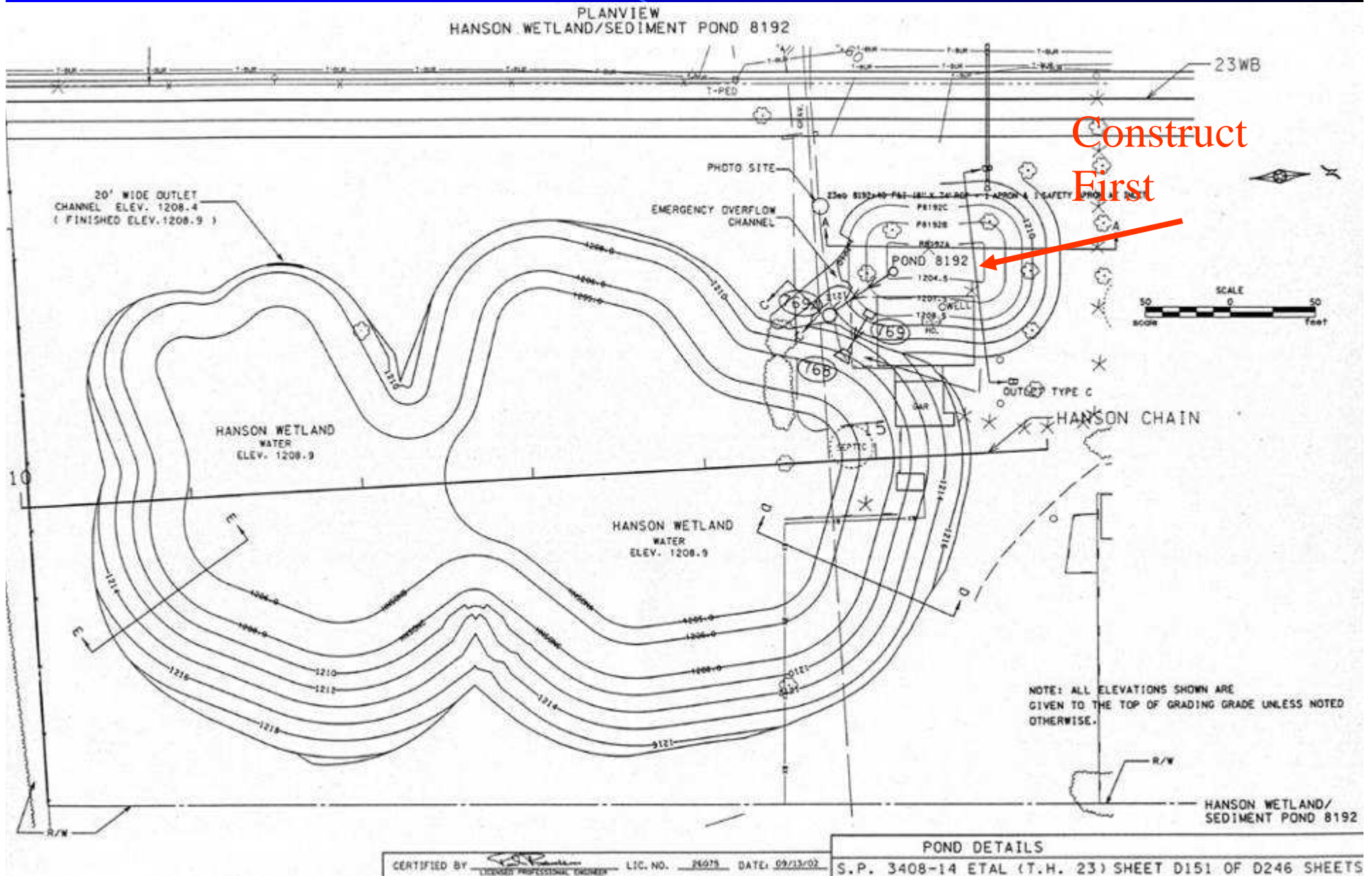
Provide Appropriate Perimeter Control



Ramp Up the Perimeter Control



Provide Construction Staging





Specify the measures that need to be taken and acceptable construction methods.



Designate Who Will Implement the Storm Water Plan

- Need a point person on the part of the prime contractor that is responsible overall
- The point person is the contractors EROSION CONTROL SUPERVISOR
- The subcontractors also need to have trained foreman so that the work can be coordinated and implemented.

Risk Management in Many Forms - SWPPP must address:

- Soil, sediment
- Paints and solvents
- Pesticides, herbicides
- Fertilizers
- Detergents
- Plaster or related products
- Concrete compounds
- Asphalt compounds
- Petroleum products
 - Fuel, oil, grease
- Hazardous chemicals
 - Acids, lime, glues, adhesives, curing compounds

Risk Assessment

Erosion and Sediment Control Problems

from State of Washington

